Assignment 6: 2D Transformation

2D TRANSFORM

```
#include <GL/freeglut.h>
#include <GL/gl.h>
#include <math.h>
#include <stdio.h>

struct Pt
{
	int x,y;
};

int numv,cnt;
bool inp;
Pt points[10];

void initGlobalVars(){
	inp=false;
	cnt=0;
	numv=0;
}

/* ----------------------- DDA LINE ALGORITHM ----------------------- */
void LineDDA(int x1,int y1,int x2,int y2)
{
	float dx,dy,incx,incy;
	float x,y;
	int steps,i;
	dx=x2-x1;
	dy=y2-y1;
	steps=(abs(dx)>abs(dy))?abs(dx):abs(dy);

	incx=dx/float(steps);
	incy=dy/float(steps);

	x=x1;y=y1;

	glBegin(GL_POINTS);

	glVertex2f(x,y);

	for(i=0;i<steps;i++)
	{
		x+=incx;
```

```
                y+=incy;
                glVertex2f(x,y);
        }
        glFlush();
        glEnd();
}
/*-------------- INITIALISE DRAWING WINDOW --------------*/
void init()
{
   glClearColor(0.0, 0.0, 0.0, 0.0);
   glClear(GL_COLOR_BUFFER_BIT);
   glColor3f(1.0, 1.0, 1.0);
        gluOrtho2D(0,500,0,500);
   //glOrtho(-1.0, 1.0, -1.0, 1.0, -1.0, 1.0);

   LineDDA(0,250,500,250);
        LineDDA(250,0,250,500);

        glRasterPos3f(0,246,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'<');
        glRasterPos3f(490,246,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'>');
        glRasterPos3f(246,0,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'v');
        glRasterPos3f(246,487,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'^');

        glColor3f(1.0,1.0,0.0);
}

void clrScr()
{
        glClear(GL_COLOR_BUFFER_BIT);
   glColor3f(1.0, 1.0, 1.0);
   LineDDA(0,250,500,250);
        LineDDA(250,0,250,500);
        glRasterPos3f(0,246,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'<');
        glRasterPos3f(490,246,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'>');
        glRasterPos3f(246,0,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'v');
        glRasterPos3f(246,487,1);
        glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18,'^');
        glColor3f(1.0,1.0,0.0);
}
```

```
void drawFig(){
	int i;
	//clrScr();
	for(i=0;i<numv-1;i++)
	{
		LineDDA(points[i].x,points[i].y,points[i+1].x,points[i+1].y);
	}
	LineDDA(points[0].x,points[0].y,points[i].x,points[i].y);
}
/*--------------------------- INPUT VERTICES ---------------------------*/
void input(){
	int ch,i,x,y;
	if(inp==true){
		printf("\nAlready Input\n");
		return;
	}
	printf("\nENTER NUMBER OF VERTICES :: ");
	scanf("%d",&numv);
	printf("Input points using :-\n1.Keyboard\n2.Mouse\nENTER CHOICE ::");
	scanf("%d",&ch);
	if(ch!=1)
		return;
	for(i=0;i<numv;i++)
	{
		printf("\nENTER POINT (X Y) :: ");
		scanf("%d %d",&x,&y);
		points[i].x=250+x;
		points[i].y=250+y;
	}
	inp=true;
}
/*--------------------------- MOUSE FUNCTION ---------------------------*/
void mouseinp(int button,int action,int xMouse,int yMouse){
	if(inp==false)
	{
		if(cnt<numv)
		{
			if(button==GLUT_LEFT_BUTTON && action==GLUT_DOWN)
			{
				//printf("%d %d",xMouse,yMouse);
				points[cnt].x=xMouse;
				points[cnt].y=500-yMouse;
				cnt++;
			}
		}
```

```
                else
                {
                        inp=true;
                        drawFig();
                }
        }
}
/*---------------------- TRANSLATE -------------------------*/
void translate(float tx,float ty)
{       int i;
        for(i=0;i<numv;i++)
        {
                points[i].x+=tx;
                points[i].y+=ty;
        }
}
/*---------------------- ROTATE -------------------------*/
void rotate(){
        float ang,angsin,angcos,x,y;
        int i;

        printf("\nENTER ANGLE OF ROTATION :: ");
        scanf("%f",&ang);
        ang=(ang*3.141)/180;
        angsin=sin(ang);
        angcos=cos(ang);

        for(i=0;i<numv;i++)
        {

                x=points[i].x-250;
                y=points[i].y-250;

                //printf("\n%f %f\n",x,y);

                x=(x*angcos)-(y*angsin);
                y=((points[i].x-250)*angsin)+(y*angcos);

                points[i].x=x+250;
                points[i].y=y+250;

                //printf("\n%d %d\n",points[i].x,points[i].y);
        }
        glColor3f(1.0,0.0,0.0);
}
/*---------------------- SHEAR -------------------------*/
```

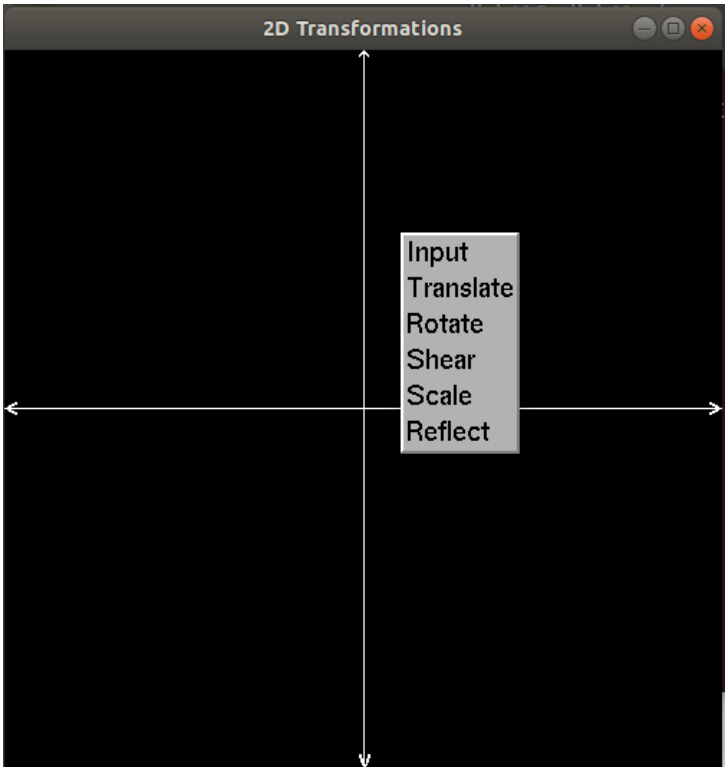
```
void shear(){
	int ch,i;
	float x,y;
	printf("\n1.X - SHEAR\n2.Y - SHEAR\nENTER CHOICE :: ");
	scanf("%d",&ch);
	if(ch==1)
	{
		printf("\nENTER X - SHEAR FACTOR :: ");
		scanf("%d",&ch);
		for(i=0;i<numv;i++)
		{
			x=points[i].x-250;
			y=points[i].y-250;
			x=x+(y*ch)-((points[0].y-250)*ch);
			points[i].x=x+250;
			points[i].y=y+250;
		}
	}
	else if(ch==2)
	{
		printf("\nENTER Y - SHEAR FACTOR :: ");
		scanf("%d",&ch);
		for(i=0;i<numv;i++)
		{
			x=points[i].x-250;
			y=points[i].y-250;
			y=y+(x*ch)-((points[0].x-250)*ch);
			points[i].x=x+250;
			points[i].y=y+250;
		}
	}
	else
	{
		printf("\n!! INVALID INPUT !!\n");
	}
}
/*---------------------- SCALE -------------------------*/
void scale(float sx,float sy)
{
	float x,y,xi,yi;
	int i;
	xi=points[0].x;
	yi=points[0].y;
	for(i=0;i<numv;i++)
	{
		x=points[i].x-250;
```

```
                y=points[i].y-250;
                x=(x*sx);
                y=(y*sy);
                points[i].x=x+250;
                points[i].y=y+250;
        }
        translate(xi-points[0].x,yi-points[0].y);
        glColor3f(0.0,1.0,0.0);
}
/*---------------------- REFLECT -------------------------*/
void reflect(){
        int ch,i;
        float x,y;
        printf("REFLECTION ABOUT :-\n1.X - AXIS\n2.Y - AXIS\n3.ORIGIN\nENTER
CHOICE :: ");
        scanf("%d",&ch);
        switch(ch)
        {
                case 1:
                        for(i=0;i<numv;i++){
                                y=(-1)*(points[i].y-250);
                                points[i].y=250+y;
                        }
                        break;
                case 2:
                        for(i=0;i<numv;i++){
                                x=(-1)*(points[i].x-250);
                                points[i].x=250+x;
                        }
                        break;
                case 3:
                        for(i=0;i<numv;i++){
                                x=(-1)*(points[i].x-250);
                                y=(-1)*(points[i].y-250);
                                points[i].y=250+y;
                                points[i].x=250+x;
                        }
                        break;
        }
        glColor3f(1.0,.38,.01);
}

void menu(GLint ch)
{
        float sx,sy;
        switch(ch)
```

```
	{
		case 1:// Input
			input();
			break;
		case 2:// Translate
			printf("\nENTER TRANSLATION FACTORS (X Y) :: ");
			scanf("%f %f",&sx,&sy);
			translate(sx,sy);
			break;
		case 3:// Rotate
			sx=250.0-points[1].x;
			sy=250.0-points[1].y;
			translate(sx,sy);
			rotate();
			translate(-sx,-sy);
			break;
		case 4:// Shear
			shear();
			break;
		case 5:// Scale
			printf("\nENTER SCALING FACTORS (X Y) :: ");
			scanf("%f %f",&sx,&sy);
			scale(sx,sy);
			break;
		case 6:// Reflect
			reflect();
			break;
	}
	drawFig();
}

int main(int argc, char** argv)
{
   glutInit(&argc, argv);
   glutInitDisplayMode(GLUT_SINGLE);
   glutInitWindowSize(500,500);       // Define Window Size
   glutInitWindowPosition(100,100);// Define Window Position
   glutCreateWindow("2D Transformations");
        init();   // Initialise drawing window
        initGlobalVars(); // Initilaise Global Variables
   glutDisplayFunc(drawFig);// Declare Drawing Function
   glutMouseFunc(mouseinp);           // Declare Mouse Function

   glutCreateMenu(menu);     // Define Menu
        glutAddMenuEntry("Input",1);
        glutAddMenuEntry("Translate",2);
```

```
        glutAddMenuEntry("Rotate",3);
        glutAddMenuEntry("Shear",4);
        glutAddMenuEntry("Scale",5);
        glutAddMenuEntry("Reflect",6);
    glutAttachMenu(GLUT_RIGHT_BUTTON); // Attack menu to right mouse button

    glutMainLoop();
    return 0;
}
```

OUTPUT:



ROTATION AND FILLING

```
#include <GL/freeglut.h>
#include <GL/gl.h>
#include <iostream>
using namespace std;

struct Color//declare color stucture
{
	float r,g,b;
};

Color getPixelcolor(float x,float y)//get pixelcolor
{
	Color c;
	glReadPixels(x,y,1,1,GL_RGB,GL_FLOAT,&c);//get color in 'c'
	return c;//return c
}//end

void setPixelcolor(float x,float y)
{
	glBegin(GL_POINTS);//draw point
		glColor3f(1.0,0.0,0.0);//set point color to red
		glVertex2f(x,y);
	glEnd();
}//end

void floodfill(float x,float y)
{
	Color c = getPixelcolor(x,y);//gets color of current pixel
	Color old = {1.0,1.0,1.0};

	if(c.r == old.r && c.g == old.g && c.b == old.b)//if color of current pixel if white
	{
		setPixelcolor(x,y);//set pixel color to red
		floodfill(x+1,y);//call floodfill recursively for four-connected points
		floodfill(x,y+1);
		floodfill(x-1,y);
		floodfill(x,y-1);
	}
	return;
}//end

void render()
{
	glClearColor(1.0,1.0,1.0,0.0);//clear color to white
```

```
	glClear(GL_COLOR_BUFFER_BIT);//set color
	glMatrixMode(GL_PROJECTION);//set matrix mode
	glLoadIdentity();//load identity matrix
	gluOrtho2D(0,400,0,400);//sets axis length
	glFlush();//flush buffer and execute all command
}//end



void draw()//draw '+' Diagram
{
	glBegin(GL_LINES);
		glColor3f(0.0,0.0,0.0);//sets black color
		glVertex2d(100,150);
		glVertex2d(100,200);

		glVertex2d(100,200);
		glVertex2d(50,200);

		glVertex2d(50,200);
		glVertex2d(50,220);

		glVertex2d(50,220);
		glVertex2d(100,220);

		glVertex2d(100,220);
		glVertex2d(100,270);

		glVertex2d(100,270);
		glVertex2d(120,270);

		glVertex2d(120,270);
		glVertex2d(120,220);

		glVertex2d(120,220);
		glVertex2d(170,220);

		glVertex2d(170,220);
		glVertex2d(170,200);

		glVertex2d(170,200);
		glVertex2d(120,200);

		glVertex2d(120,200);
		glVertex2d(120,150);
```

```
            glVertex2d(120,150);
            glVertex2d(100,150);

        glEnd();//end
        floodfill(110,210);//fill '+' Diagram
        glFlush();//flush buffer and execute all command
}//end

void rotate()//draw '+' Diagram
{
        float y_tra = 210 - (320/1.41);//y-translation to have same level
        glBegin(GL_LINES);
            glColor3f(0.0,0.0,0.0);//sets black color
            glVertex2d(400+(-50/1.41),250/1.41 + y_tra);
            glVertex2d(400+(-100/1.41),300/1.41 + y_tra);

            glVertex2d(400+(-100/1.41),300/1.41 + y_tra);
            glVertex2d(400+(-150/1.41),(250/1.41) + y_tra);

            glVertex2d(400+(-150/1.41),(250/1.41) + y_tra);
            glVertex2d(400+(-170/1.41),270/1.41 + y_tra);

            glVertex2d(400+(-170/1.41),270/1.41 + y_tra);
            glVertex2d(400 + (-120/1.41),320/1.41 + y_tra);

            glVertex2d(400 + (-120/1.41),320/1.41 + y_tra);
            glVertex2d(400 +(-170/1.41),370/1.41 + y_tra);

            glVertex2d(400 +(-170/1.41),370/1.41 + y_tra);
            glVertex2d(400+(-150/1.41),390/1.41 + y_tra);

            glVertex2d(400+(-150/1.41),390/1.41 + y_tra);
            glVertex2d(400+(-100/1.41),340/1.41 + y_tra);

            glVertex2d(400+(-100/1.41),340/1.41 + y_tra);
            glVertex2d(400+(-50/1.41),390/1.41 + y_tra);

            glVertex2d(400+(-50/1.41),390/1.41 + y_tra);
            glVertex2d(400+(-30/1.41),370/1.41 + y_tra);

            glVertex2d(400+(-30/1.41),370/1.41 + y_tra);
            glVertex2d(400+(-80/1.41),320/1.41 + y_tra);

            glVertex2d(400+(-80/1.41),320/1.41 + y_tra);
            glVertex2d(400+(-30/1.41),270/1.41 + y_tra);
```

```
            glVertex2d(400+(-30/1.41),270/1.41 + y_tra);
            glVertex2d(400+(-50/1.41),250/1.41 + y_tra);

        glEnd();//end
        floodfill(400+(-100/1.41),320/1.41 + y_tra);//fill rotated Diagram
        glFlush();//flush buffer and execute all command
}//end

void mouse(int button,int state,int x,int y)//On only when menu is commented
{
        if(button == GLUT_LEFT_BUTTON && state == GLUT_UP)//if left button and up
        {
            render();//draw '+' diagram
            draw();
        }
        else if(button == GLUT_RIGHT_BUTTON && state == GLUT_UP)//if right button and
up
        {
            render();//draw '+' and rotated diagram
            draw();
            rotate();
        }
}//end

int main(int argc,char **argv)//taking command line orguments
{
        int e;
        glutInit(&argc,argv);//initialise glut with libraries
        glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);//initalise mode
        glutInitWindowPosition(1000,200);//sets position of window
        glutInitWindowSize(400,400);//sets size of window
        glutCreateWindow("Practical");//create window
        glutMouseFunc(mouse);//activate mouse function(activated only when menu is commented)
        render();//call to function
        do
        {
            cout<<"*Menu = \n1 : Given Diagram\n2 : Rotated Diagram\n3 : Exit\n";//create menu
            cout<<"Enter Your Choice = ";
            cin>>e;
            switch(e)
            {
                case 1://Draw '+' Diagram
                    render();//clear screen
                    draw();
                    break;
```

```
                case 2://Draw rotated '+' Diagram
                        rotate();
                        break;

                case 3://exit from program
                        exit(1);
                }
        }while(e);

        glutMainLoop();//infinite loop untill user closes window
return 0;
}//end of program
```

OUTPUT: